


MICHIGAN STATE
UNIVERSITY


Agricultural, Food and
Resource Economics

Thoughts on the Economics of Low
Carbon Fuel Standard for Michigan

Steven Miller, Ph.D., *Michigan State University*

MICHIGAN STATE
UNIVERSITY
EXTENSION

CHALLENGE OF
AGRICULTURE
AND NATURAL
RESOURCES

maes
research
MICHIGAN STATE
UNIVERSITY

Outline

- Estimated macroeconomic impact of the Michigan Climate Action Council recommendation on low carbon fuels
- Look at the carbon footprint of current biofuel technologies
- Discuss Michigan's biofuels potential
- Review some challenges to address

Low Carbon Fuel Standard (LCFS)

- Works in principle like a Renewable Fuels Standard
 - Providers opt for the most cost-effective means to reaching standard on a full-cycle basis
 - Multiple paths to reaching standard
 - Process low GHG petroleum
 - Utilize low GHG processes
 - Promote low carbon blends
 - Purchase carbon credits
 - Promotes innovation toward reaching standards without rigid mandates
 - Some argue LCFS provides more market-based directives than taxes and incentives

Outcome of Macroeconomic Impact Study of MCAC

■ MCAC Recommendation (TLU-1)

- Achieve a 5% reduction in GHG on a life cycle carbon dioxide basis by 2015
- Achieve a 10% reduction by 2025
- Achieve biofuels use of 10% transportation fuel consumption by 2012
- Achieve biofuels use of 25% by 2025
- Establish retail and wholesale incentives for E85 and B20 sales

Macroeconomic Impact

■ Assumptions

- Biofuels supplant 25% of baseline petroleum transportation fuels by 2025 with associated cost differences per btu
- Biofuels are produced in Michigan
- 21.85% of annual car sales is flex-fuel by 2025
- Only 50% of car sales represents new investment
- Cumulative investment of \$80.8 million in service stations 2009-2025

Macroeconomic Impact

- Applied the REMI Policy Insight Model for Michigan
 - Replacing oil imports with local feedstocks offset relative price increase in transportation fuels
 - Investment in infrastructure adds additional impacts
- Contributes **\$660 million** to Gross Regional Product in 2025 (+0.18%)
- Generates **11,158 new jobs** by 2025 (+0.25%)
- Fuel price impacts are likely neutral due to technological advances in biomass conversion

Macroeconomic Impact

- Questions that need to be considered
 - Michigan's biomass potential?
 - Optimal policy and market structure for Michigan?
 - True full-cycle carbon footprint measures?
 - Ecological impacts besides CO₂?
 - How will Michigan sustain a competitive advantage in biofuels?
 - Who are the winners and losers (distribution of impacts)?

Measuring Full-Cycle Carbon Footprint

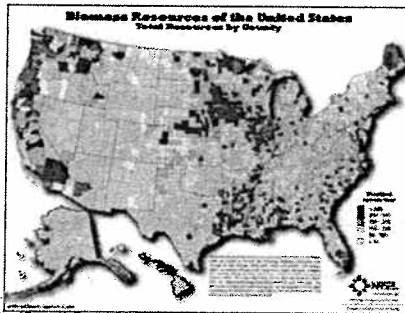
- Life Cycle Analysis (LCA) calculates the GHG emissions from transportation fuels from seed (or well) to wheel
 - LCA is governed by ISO 14001 standards
 - Raw material acquisition and transportation
 - Liquid fuels production and transportation
 - Consumption
- Indirect Land Use Changes (ILUC) asserts that land devoted to energy crops eventually leads to conversion of carbon sinks
 - Controversial and difficult to quantify
 - If fuel crops increase the demand for land, grass or forest land will eventually be converted to agricultural uses

Valuing Transportation GHG Mitigation

- Through 2030, carbon credits are expected to trade at:
 - \$40-\$90* per metric ton CO₂e
 - Equates to \$0.35 - \$0.90 per gallon of petroleum transportation fuel on a life cycle basis

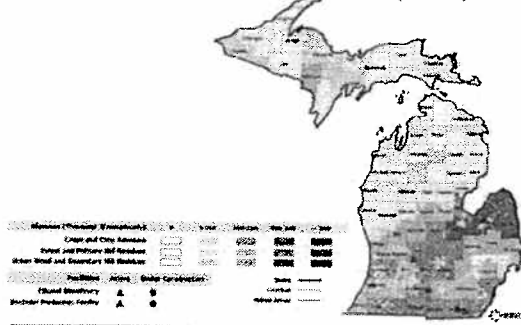
* US EPA, 2008 EPA Analysis of the Lieberman-Warner Climate Security Act of 2008. USEPA, Washington, DC

U.S. Biomass Resources (2008)



Source: National Renewable Energy Laboratory
<http://www.nrel.gov/biomass/>

Michigan Biomass Potential (2008)



Source: US Department of Energy, Alternative Fuels & Advanced Vehicles Data Center
<http://www.afvc.gov/alternative-fuels/>

Michigan Biomass Potential (2008)

- While significant biomass generation potential, more research is needed
 - How many acres are available for biomass production?
 - What are the ecological ramifications?
 - What is the best mix of economies of scale and transportation in biomass acquisition? For fuel conversion?
 - What role for urban green-space in biofuels and food production?
 - What prices will motivate instate production of feedstocks?
 - What are the potential unintentional outcomes of Michigan's climate action policy mix?

Source: US Department of Energy, Alternative Fuels & Advanced Vehicles Data Center
<http://www.afvc.gov/alternative-fuels/>

Conclusion

- The macroeconomic impact analysis of MCAC suggests there is a positive impact of LCFS
- 13 of the MCAC policy recommendations address biofuels
- Many questions remain
- A wealth of biomass production opportunities
- Great Lakes Bioenergy Research Center and MSU
- As biofuels make up a substantial component of Michigan's Climate Action Plan,



For further information, contact

Steven R. Miller Ph.D.
88 Agriculture Hall
Michigan State University
East Lansing, MI 48824
(517) 355-2153
mill1707@msu.edu